Tides

Answer Key

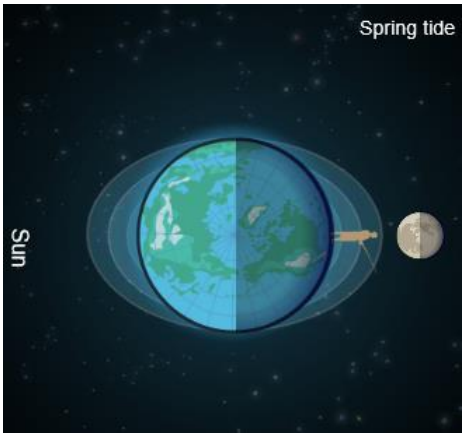
Vocabulary: gravity, high tide, low tide, neap tide, spring tide, tidal bulge, tides

Prior Knowledge Question (Do this BEFORE using the Gizmo.)
[Note: The purpose of these questions is to activate prior knowledge and get students thinking. Students are not expected to know the answers to the Prior Knowledge Questions.]

What is happening in these images?

Answers will vary. [The images show the effects of tides in the Bay of Fundy. High tide is shown at left, and low tide is shown at right.]

Gizmo Warm-up
The *Tides* Gizmo™ shows the relative positions of the Earth, Moon, and Sun. (None of the distances are to scale.) An observer stands on Earth.



1. Set the **Speed** to **Slow**. Select the BAR CHART and press **Play** (▶). What do you notice?

   Earth spins in a counterclockwise direction. On the bar chart, the water level goes up and down.

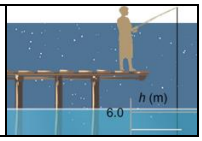
   The changing depth of water is due to **tides**.

2. Click **Pause** (⏸) when the water is at its highest level. This is called **high tide**. What is the height of water during high tide? *6 meters high.*

3. Click **Play**, and then **Pause** when the water is at its lowest level, called **low tide**. What is the height of water during low tide? *3 meters high*.

4. Click **Reset** (↺). Click **Play**, and then click **Pause** after one day. Select the GRAPH tab.

   How many high tides are there in a day? *Two* Low tides? *Two*

Activity A: **The Moon and tides**	Get the Gizmo ready: • Click **Reset**. • Select the BAR CHART tab.	

Question: What causes high and low tides?

1. Observe: Click **Play** and watch the tides for a while on the BAR CHART and SIMULATION panes. Notice the oblong bands of water around Earth. These are **tidal bulges**.

   A. How many tidal bulges are there? *There are two tidal bulges.*

   B. What kind of tide does the observer experience as he passes through a tidal bulge?

   The observer experiences high tide.

   C. What kind of tide does the observer experience when he is between tidal bulges?

   The observer experiences low tide.

   D. In one day, how many times does the observer pass through a tidal bulge? *Twice*

2. Form hypothesis: What do you think causes the tidal bulges to form? *Hypotheses will vary.*

3. Observe: Set the **Speed** to **Fast** and click **Play**. What do you notice about the tidal bulges and the position of the Moon?

   The tidal bulges are always aligned with the Moon (one bulge always points toward the Moon and the other bulge always points away from the Moon).

4. Draw conclusions: How does the Moon influence the tides?

   The Moon's gravity causes the tides. The gravity pulls on the oceans, creating a tidal bulge near the Moon.

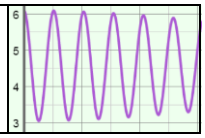
5. Extend your thinking: The Moon's **gravity** pulls on Earth.

   A. How does the Moon's gravity affect the oceans nearest to the Moon?

   The Moon's gravity pulls water into a tidal bulge.

   B. What happens on the side of Earth opposite the Moon?

   A second tidal bulge forms. [This bulge is formed because the Moon's gravity pulls Earth away from the water on the side of Earth opposite the Moon. See the Teacher Guide for a more complete explanation.]

Activity B: **The Sun and tides**	Get the Gizmo ready: • Click **Reset**. • Select the GRAPH tab.	

Question: How does the Sun influence tides?

1. Observe: Set the **Speed** to **Fast** and click **Play**. Observe the shape of the tidal bands over time. After 15 days or so, click **Pause**. How do the tidal bands change over time?

   For the first seven days, the tidal bands get more circular. For the next seven days, the tidal bands get more oblong.

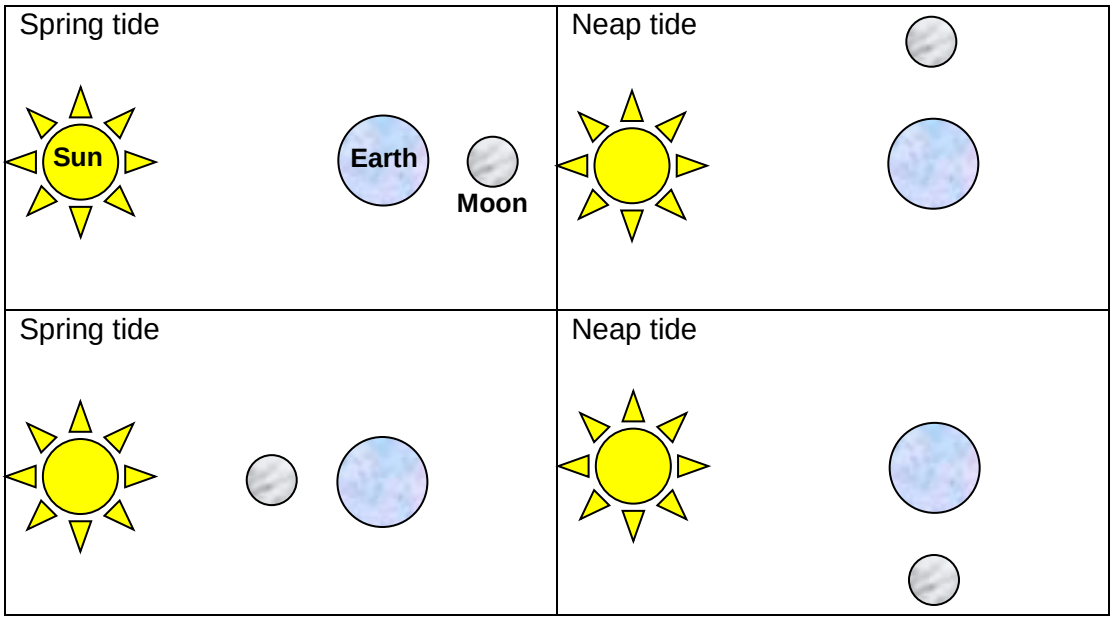
2. Analyze: On the GRAPH tab, click the "**–**" button twice to zoom out.

   A. What do you notice? *The graph looks like an hourglass on its side.*

   B. When the high tide is very high, and the low tide is very low, it is a **spring tide**. On which days did the observer experience a spring tide? *Day 0 and days 14-15.*

   C. When there is a smaller difference between high and low tide, it is a **neap tide**. On which day did the observer experience a neap tide? *Day 7*

3. Sketch: As the Moon orbits Earth, there are two periods of spring tides and two periods of neap tides. Sketch the positions of the Earth, Moon, and Sun for each spring and neap tide.



(Activity B continued on next page)

Activity B (continued from previous page)

4. Analyze: List the type of tide (spring or neap) that occurs in each situation:

    A. The gravity of the Sun and Moon pull Earth's surface in the same direction: *Spring*

    B. The gravity of the Sun and Moon pull Earth's surface in opposite directions: *Spring*

    C. The gravity of the Sun and Moon pull Earth's surface at right angles: *Neap*

5. Draw conclusions: How does the Sun's gravity influence tides?

    The Sun's gravity does not influence tides as much as the Moon's gravity. The Sun's gravity can make tides greater or smaller. When the Sun's gravity is aligned with the Moon's gravity, high tide is higher and low tide is lower. When the Sun and Moon pull at right angles to each other relative to Earth, high tides are lower and low tides are higher.

6. Extend your thinking: Think about how the Moon would look for the observer on Earth.

    A. What kind of tides (spring or neap) would you expect during a full Moon? *Spring*

    B. What kind of tides would you expect during a new Moon? *Spring*

    C. What kind of tides would you expect during a half Moon? *Neap*